alike and so highly specialized, connected, too, in such an unusual way with the cranium, have developed from two extremely different sources; that (1) the usual dentigerous bones have retained in the platyschistous eels, the functions performed in other fishes but under a highly specialized form, while (2) they have been lost in the engyschistous eels and bones (palatopterygoid), which had been much reduced or atrophied in the others, have been highly developed in the same manner but at the expense of the dentigerous bones of the typical eels. No reason has been assigned for such interpretations but it is probable that the posterior connection with the cranium of the dentigerous bones of the Muraenids was one cause. We are thus forced into one or other of the two forks of a dilemma: which is the more probable, (1) that bones of two very distinct and disconnected arches have been inversely developed at the expense of each other in a like highly specialized manner, or (2) that the vomer-ethmoid has projected in one type (Colocephals) more than in the others (Euchelycephals)? The latter alternative has been preferred by the present author.

As to the premaxillaries, they have been considered to have been lost by recent ichthyologists, but it is at least possible (or even probable) that they have been consolidated with the ethmo-vomer, as Peters and Jacoby contended.

The order, as now limited, is represented by two suborders, (1) the Enchelycephals, including most of the species, and (2) the Colocephales, including (so far as known) only the Muraenids. The only near relations of the apodals are the Carencheli, known only by a single species, which is distinguished by the distinct premaxillaries, free nasals, etc.

The Lyomeri, which have been generally associated with the apodals, are extremely distant and *contrast* with them by the absence of most of the characters distinctive of the order.

THEO. GILL

THE PROPER RESTRICTION OF EUCYNOPOTAMUS

SOME time ago I proposed the name *Evermannella* to replace *Odontostomus,* as the latter was found to be preoccupied in mollusca. Since then, Dr. C. H. Eigenmann, overlooking my use of this name, again proposed *Evermannella* as a new genus of Characinae. with *Cynopotamus biserialis* Garman as its type. Subsequently I renamed Dr. Eigenmann's genus *Eucynopotamus,* a fact he seems to have entirely neglected, as his later proposal of *Evermannolus* shows. Thus *Evermannolus* must be considered an exact synonym of *Eucynopotamus,* embracing the single species *E. biserialis.* The wrongly identified genus *Eucynopotamus* of Eigenmann may now be known as GALEOCHARAX gen. nom. nov. (type *Cynopotamus gulo* Cope), to embrace the species *G. magdalenæ, G. humeralis, G. gulo* and *G. knerii.*

HENRY W. FOWLER

ACADEMY OF NATURAL SCIENCES
OF PHILADELPHIA

THE AMERICAN PHYTOPATHOLOGICAL SOCIETY. II

The Mildew of Ginseng caused by Phytophthora Cactorum (Leb. & Cohn) Schroeter: Professor H. H. Whetzel, Cornell University. (Read by Mr. V. B. Stewart.)

The mildew has long been known to the ginseng growers of Japan. It is known as "Koshi-ore," meaning a "bending-at-the-loins," from the characteristic drooping of the leaflets at the end of the affected petiole.

The relation of *Phytophthora cactorum* to the disease was first discovered by Hori in 1904 as pointed out by Van Hook. He demonstrated the constant association of this well-known Phycomycete with the lesions on the ginseng. Van Hook discovered this disease in Ohio and New York in May, 1905. He reports the constant abundance of oospores of *P. cactorum* in the diseased stems. So far as can be determined from the literature on the subject, no inoculation experiments have even been made to definitely establish the causal relation of this parasite to this disease.

The writer has observed this disease on an occasional plant in ginseng gardens since 1906. An epidemic of it appeared in a large ginseng plantation in New York State in 1909, causing a loss of more than 20 per cent. in some beds. Microscopical examination of a large number of diseased plants showed the *Phytophthora* always present in great abundance.

A careful study was made of the morphology of the parasite and its relation to the host tissues. These studies showed much the same conditions as those reported by Hartig for this fungus on forest seedlings.

A series of careful inoculation experiments were made as follows: (*a*) with conidia from diseased plants to healthy ones, (*b*) with motile swarm spores in water to healthy plants, (*c*) with mycelium from pure cultures of the fungus to healthy plants.

In every case there was prompt infection, with the resulting lesions characteristic of the disease. Microscopical examination of the diseased portions showed the conidia and mycelium of *P. cactorum* in abundance.

Pure cultures of the fungus were obtained by peeling back the epidermis on diseased stems and transferring bits of diseased tissue to sterilized bean pods. Oospores are produced abundantly in cultures. The isolation of this fungus in pure culture has not heretofore been accomplished, so far as the writer knows. It is therefore the third species of the genus *Phytophthora* to be brought under cultivation.

On the Relationship of certain Bacterial Softrots of Vegetables: Professor W. J. MORSE, Maine Agricultural Experiment Station, and Dr. H. A. HARDING, New York Agricultural Experiment Station.

The organisms studied include several named species of soft-rot bacteria, in addition to nearly forty other strains isolated during the progress of the investigation. They represent pathogens from various cultivated vegetables, and one each from the iris and calla lily, obtained from widely separated sections of Europe and the United States.

The data were accumulated in two different laboratories, extending over a period of several years, and the more important determinations were checked by four different workers. Some 12,000 subcultures were used and over 1,500 fermentation tube tests made, resulting in the conclusion that the organisms comprising the group are identical in all morphological, cultural, physical and biochemical features except in ability to ferment dextrose, lactose and saccharose.

An almost complete series of organisms was obtained, showing all except two of the possible combinations of fermentative ability from an organism which regularly produced visible gas in fermentation tubes containing any one of the three carbohydrates mentioned to one which never produced visible gas from either of them. While the final decision as to classification is reserved till work upon the pathogenicity of the various strains or described species is completed, the writers feel that based on the bacteriological studies alone the group should be considered as one somewhat variable species of which *Bacillus carotovorus* Jones is the earliest described and should therefore be considered as the type.

(Data to appear as Technical Bulletin 11 of the New York Experiment Station, and in the Twenty-first Annual Report of the Vermont Experiment Station.)

Timothy Rust in the United States: Mr. EDW. C. JOHNSON, Bureau of Plant Industry.

Timothy rust was reported in the United States by Trelease as early as 1882. Pammel reported it from Iowa in 1891. From 1891 to 1906 no mention of the parasite in the United States has been found. In 1906 the rust became epidemic in the timothy-breeding plats at the Arlington Experiment Farm, Virginia. Since then the rust has been common in many localities. It has been reported from all the states east of the Mississippi and north of Tennessee with the exception of the New England states, New Jersey and Illinois, and from Minnesota and Iowa.

The rust is similar in general appearance and morphological characteristics to *Puccinia graminis* Pers., on wheat. Its æcial stage is not definitely known in this country. Eriksson and Henning, working with a rust on timothy in Sweden, were able to produce æcia on barberries once in nine trials, and that only in one place of inoculation against 92 places inoculated with negative results. In trials in 1895 they again were unsuccessful in 25 inoculations on barberries. They concluded that the rust is a distinct species and named it *Puccinia Phlei-pratensis.* Kern considers it "a race of *Puccinia poculiformis* (*graminis*) or a so-called physiological species."

Inoculation experiments with timothy rust on various grasses in the greenhouses at Washington, D. C., demonstrate that the rust in the United States and the rust in Europe are identical, and that the species is not well fixed. The rust transfers easily to *Avena sativa, Secale cereale, Festuca elatior, Dactylis glomerata, Arrhenatherum elatius* and *Poa compressa.* Inoculations directly on *Triticum vulgare* and *Hordeum vulgare* give negative results.

Timothy plants brought into the greenhouse from Arlington Experiment Farm, Virginia, Jan-

uary 19 and March 12, 1908, began to produce fresh uredospores within six days after transplanting. In the field fresh rust pustules on new growth of timothy were common from March 13 on. Thus the rust mycelium is able to live through the winter in this locality. How the rust winters further north has not been determined. The teleuto stage is more common in Pennsylvania and New York than at the Arlington Experiment Farm, but as the æcial stage is perhaps rare in the United States the occurrence of teleutospores is of doubtful importance.

In timothy-breeding work at the Arlington Experiment Farm in 1908 and 1909, W. J. Morse, of the United States Department of Agriculture, found that the difference in varietal resistance of timothies to rust is well marked. This has also been determined in greenhouse experiments, and, although no variety or strain of timothy has been found to be entirely immune, there is a very noticeable difference in the degree of susceptibility of the different varieties to rust.

Floret Sterility of Wheats in the Southwest: Mr. EDW. C. JOHNSON, Bureau of Plant Industry.

Floret sterility of wheat, or the non-development of kernels in florets of otherwise normal spikelets, is common in the southwest, especially in parts of Texas and Oklahoma. The trouble has been variously attributed to insects, imperfect fungi, rusts and physiological conditions, but until recently no experiments have been performed to demonstrate what are the principal causes.

In 1908 and 1909 investigations were undertaken at San Antonio, Texas. There the per cent. of sterile florets in wheats was 30 to 50 per cent. and 12 to 15 per cent. for the two years, respectively. Although the exact rôle played by wheat thrips was not established, their importance as agents for spore dissemination was noticed. As many as five rust spores and three conidial spores of imperfect fungi were observed on the antennæ and appendages of a single thrip. As the thrips are exceedingly active and penetrate between the glumes of florets, spores are often carried into the young wheat flowers.

Ovaries of sterile florets were almost invariably affected with fungi. *Cladosporium graminum* Cda., and *Stemphylium* n. sp. were common on the leaves and diseased ovaries of affected grain and rusts, both *Puccinia graminis* Pers. and *Puccinia rubigo-vera* (D. C.) Wint., almost invariably were present in the florets. Inoculation of florets with spores of pure cultures of *Cladosporium graminum* Cda. and *Stemphylium* n. sp. were made by dropping a mixture of spores and water between the glumes held apart with tweezers. This increased the percentage of sterile florets. The increase amounted to three per cent. where 432 florets were inoculated with the former species and 195 florets similarly treated with sterile water were used for control, and 1.9 and 9.19 per cent., respectively, where 186 and 301 florets were inoculated with the latter, and 195 and 198 florets treated with sterile water were used for controls.

Similar inoculations with uredospores of *Puccinia graminis* increased the sterility 21.03 per cent. where 93 florets were inoculated and 206 florets were used for control. In two sets of inoculations where the wheat heads were soaked in water full of spores an increase of sterility of 7.36 per cent. and 6.08 per cent. resulted where 85 florets and 264 florets, respectively, were inoculated and 106 florets and 151 florets similarly treated with sterile water were used for controls.

No precautions were taken to prevent drying of the heads after inoculation, except covering both inoculated and control heads with tissue paper for two days. In the hot, clear days which followed the heads dried very quickly and the per cent. of infection was reduced. In an experiment where the wheat plants were screened from the direct rays of the sun an increase of sterility of 12.32 per cent. above that in adjacent unshaded control plants resulted. No artificial inoculation was performed. Shading prevented rapid drying in the mornings and thus gave better conditions for the development of fungi.

The experiments show that rusts and associated fungi, chief of which is *Stemphylium* n. sp., are undoubtedly the most important causes of floret sterility of wheats in the southwest. That similar conditions often exist in other localities was demonstrated at Minnesota in 1909. In the plats for rust resistance breeding all the grains when in bloom were sprayed with rust spores. In all the non-resistant wheats a large per cent. of the florets produced no kernels on account of rust infection in the heads, while in adjacent unsprayed plats such sterility was not marked.

Bacterial Blight of Mulberry: DR. ERWIN F. SMITH, Department of Agriculture.

In 1890 Cuboni and Garbini studied a disease of the mulberry about Verona. This was ascribed to a *Diplococcus* believed to be identical with or akin to *Streptococcus bombycis,* supposed to be the cause of a disease of silk-worms. Successful

inoculations were claimed. In 1891–92 Macchiatti published papers on the disease, confirming the views of Cuboni and claiming successful inoculations. In 1894 Boyer and Lambert, in France, studied a blight of mulberries, obtained inoculations from cultures, and named the organism *Bacterium mori*, but did not describe it. In 1897 Peglion confirmed Macchiatti's views, obtained infections on leaves and shoots in three days' time, and stated the organism to be yellow and a liquefier of gelatin. Possibly he was working with mixed cultures.

In 1905 the writer made isolations from blighting mulberry leaves, and, influenced by the Italian work, paid attention only to such poured-plate colonies as were distinctly yellow. Two yellow forms were isolated and thorough inoculations were made on growing leaves and shoots of mulberries, but, contrary to expectation, no trace of infections was obtained. The diseased material came from Georgia.

In 1908 plates made from Georgia material showed the bulk of the bacteria in the freshly blighting stems to be a white species. With this white organism numerous successful infections were obtained on two varieties of mulberry, on both leaves and stems. With pure cultures plated from such blighting shoots, many additional infections were obtained. Independently at about the same time two of my co-workers obtained confirmatory results with the same white organism: (1) isolations and successful inoculations on the Pacific slope by Mr. P. J. O'Gara (oral communication); (2) isolations and successful inoculations in Arkansas by Mr. James Birch Rorer (oral communication). Typical-looking cultures were received from both men and with the Arkansas organism successful inoculations were made in a Department of Agriculture hothouse under my direction and also by Mr. Rorer himself. There is, therefore, no doubt whatever as to the infectious nature of the white organism. Whether the Italians who have secured infections inoculated with mixed cultures, one constituent of which was this white organism, or whether there is also a yellow organism (*Bacillus Cubonianus* Macch.) capable of causing a bacterial blight of mulberry, must be left an open question. If the latter supposition be true then *Cubonianus* is perhaps the proper specific name for the yellow organism.

Inasmuch as Boyer and Lambert obtained infections with their *Bacterium mori*, and have not made any incorrect statements respecting its character, I have adopted their name for the white organism, with the following emended characterization:

Bacterium mori B. & L. emend. Schizomycete causing a blight of leaves and young shoots of the mulberry. Spots at first water-soaked, then, sunken and black; foliage more or less distorted; shoots soon show sunken, black stripes and dead terminal portions. Action of disease rather prompt. In very young shoots all the tissues are involved—wood, pith and bark being infested by the bacteria. In older shoots the bacteria are confined mostly to the xylem and especially to the vessels, where tyloses are produced, as a result of the stimulus of the organism.

The organism is motile by means of a polar flagellum, sometimes two are present. It is actively motile when examined in a hanging drop made from a three-day agar culture. It occurs as single rods, pairs and short or long chains. The ends of the rod are rounded and the limits of size are 1.8 to $4.5\,\mu \times 0.9$ to $1.3\,\mu$. Most are $3.6\,\mu \times 1.2\,\mu$. No spores have been observed. Pseudozoogloeæ occur, and involution forms were seen in beef-bouillon containing 6 per cent. sodium chloride. It stains readily with carbolfuchsin, but not by gram.

Colonies on + 15 Agar at 23° C.—White, slow-growing, round, smooth, flat, edge entire becoming undulate after some days, internal structure reticulate or striate.

Young Agar Streaks.—Growth moderate, spreading, flat, dull, smooth, becoming finely granular, translucent, slimy, odorless, white, medium not stained.

Agar Stabs.—Best growth at top.

Potato.—Growth moderate, spreading, flat, glistening, smooth, white to dirty white, slimy and medium grayed, only slight action on the starch.

Lœffler's Blood Serum.—Streak spreading, flat, glistening, smooth, white. No change in color of substratum or liquefaction (two months).

Surface Colonies on + 10 Nutrient Gelatin.—Flat, slow-growing, round to irregular, with lobate-erose margins.

Gelatin Stabs.—Best growth at top, line of stab filiform, no stain, no liquefaction.

Peptonized Beef-broth (+ 15).—Produces a pellicle, which breaks into fragments readily and sinks, forming a flocculent fluid; strong turbid clouding (clear after three months). Growth always best at the top, no distinct odor.

Milk.—Coagulation absent, fluid becomes clear

by destruction of the fat. After three months, and considerable evaporation, the fluid is more or less gelatinous and somewhat brownish (the ochraceous to ochraceous-buff of Ridgway, and near the ochroleucous of Saccardo). In such cultures there is always a small amount of pure white bacterial precipitate and the microscope shows entire absence of fat globules. Such milk is translucent, strongly alkaline and not viscid. At no time does the culture show any acid reaction or any striking reduction of litmus. Purple litmus milk blues promptly.

Cohn's Solution.—No growth, or very scanty.

Uschinsky's Solution.—Copious growth, not viscid, heavy fragile pellicle, sinking readily. Fluid bluish-fluorescent as early as the fifth to tenth day.

Sodium Chloride.—Tolerates 6.5 per cent. sodium chloride in + 15 peptonized beef-bouillon. It also grew twice in presence of 7 per cent. sodium chloride, but failed once when less copiously inoculated and did not grow in 9 per cent. sodium chloride bouillon.

Chloroform.—Grew unrestrainedly and for a long time in bouillon standing over chloroform.

Fermentation Tubes.—Does not produce gas or cloud closed arm in peptone water containing any of the following carbon compounds: dextrose, cane-sugar, milk-sugar, maltose, glycerine or mannit. Strongly aerobic.

Indol Production.—Absent or feeble.

Nitrites.—Nitrates not reduced to nitrites in beef-bouillon.

Temperature Relations.—Thermal death point about 51.5° C. Maximum temperature for growth about 35° C. Remains alive only a short time at this temperature. Minimum temperature for growth below 1° C.

Drying.—Rather resistant on cover-glasses—alive after 30 days, and another time after 50 days.

Sunlight.—Sensitive. Exposed in thin sowings in + 15 nutrient agar in Petri dishes bottom up on ice, one half of each plate covered, seventy per cent. were killed by 15 minutes' exposure, one hundred per cent. by 35 minutes' exposure, and ninety-five per cent. by 25 minutes' exposure. Colonies on the covered side developed freely.

The following are recommended as quick tests for differential purposes: Pitfield's flagella stain, peptonized beef-broth, Uschinsky's solution, Cohn's solution (5 days), litmus milk, nitrate bouillon, sodium chloride bouillon (5 per cent.), gelatin and agar plates; inoculation by needle-puncture into young rapidly growing shoots of susceptible species of Morus, which should show water-soaked spots in 7 days or less.

A New Spot Disease of Cauliflower: LUCIA MCCULLOCH. (Read by title.)

A New Tomato Disease of Economic Importance: DR. ERWIN F. SMITH, Department of Agriculture.

In the summer of 1909 my attention was called to a stem disease of tomatoes prevalent in the vicinity of Grand Rapids, Mich. Microscopic examinations showed absence of fungi and great numbers of bacteria with considerable destruction of the inner tissues. Petri-dish poured-plates were made from these stems and the organism occurring in the plates proved to be a yellow schizomycete. Inoculations were made on July 27 in the open with material taken directly from the stems and shaken in bouillon, and the disease (gross appearance and histological phenomena) was in this way reproduced in a number of large tomato plants, progressing slowly, however. Poured-plates made from the interior of these plants demonstrated the presence of the same yellow organism in enormous numbers and another series of inoculations was made in October in one of our hothouses, using sub-cultures from typical colonies on these poured-plates. The results were the same as in case of the direct inoculations—all the plants contracted the disease, became stunted and were finally destroyed by it, but its progress was relatively slow, one or two leaves at a time slowly wilting or yellowing and shriveling; in other words, there is not that sudden collapse of the whole plant so characteristic of the southern bacterial disease of tomatoes (photographs were passed about showing various stages of this disease as obtained by pure culture inoculations).

The bacteria are very abundant in the vascular bundles, but the brown staining is less pronounced than in case of the disease due to *Bacterium solanacearum*.

The bacteria occur in the vascular system, but also hollow out cavities in pith and bark. The foliage is stunted and becomes yellowish, one leaf and one branch after another slowly succumbing to the disease. I am not sure whether the disease begins above ground or below. Whether the fruit itself shows the bacterial infection or not must also be left an open question. In the field, tomatoes from such plants were frequently brown spotted, but the origin of this brown spotting is still in some doubt.

[Since the above paragraph was written many of our check tomatoes in hothouses have contracted the disease, also much younger tomato plants on neighboring benches, together with a purple-flowered spiny Porto Rican weed (*Solanum globiferum?*) grown in the house because of its reported resistance to the brown rot. Not in a long time have we had such a wholesale escape of a bacterial disease to our check plants, and the indications are that the disease is readily communicated from plant to plant through the parts above ground, this being favored by liberation of the bacteria through the frequent cracking open of the diseased stems. We have also found the bacteria abundant in the fruits of diseased plants.]

The losses around Grand Rapids, Mich., last year amounted to eight or ten thousand dollars, and the writer has some evidence indicating that the disease is prevalent in other parts of the northern United States, and has probably hitherto been confused with the more rapidly acting disease due to *Bacterium solanacearum.* I suspect it to be a disease of hothouses as well as of the open.

Only some preliminary notes can be offered at the present time on the cultural characteristics of this organism, which may be known as *Bacterium (?) Michiganense.* Some of these characters are as follows:

The organism when taken from the vessels is a short rod with rounded ends, single or in pairs, termo-like; taken from ten-day agar culture and stained with carbol fuchsin, the majority are 0.35 to 0.4×0.8 to $1.0\ \mu$. The writer observed no active self-motility when taken from the stem or old agar-cultures and examined in water. On staining young agar-cultures for flagella they appeared to be polar, but no good preparations were secured.

In morphology, as taken from the stem, the organism closely resembles *Bacterium solanacearum* as it occurs in the southeastern part of the United States. The organism from the stems came up rather slowly in + 15 agar-plates, the first colonies to appear being a few scattering intruders. Afterwards the right organism appeared plentifully in the form of pale yellow, smooth, wet-shining, round surface colonies not unlike those of *Bacterium campestre.* The buried colonies were small, round to broadly elliptical. The intruders in this case formed wrinkled, raised, gummy-looking, roundish yellow colonies.

Agar Stabs.—Surface growth in 15 days, at 25° C., 10 mm. in diameter, canary yellow, smooth, shining, opaque, flat, viscid. Stab growth finely saccate. Grows slowly on agar.

Corn-meal Agar Stabs.—Scanty, pale yellow surface growth. Moderate stab growth; better than in peptonized beef-agar.

Potato Cylinders.—After a month's growth moderate, spreading, thin, smooth, canary yellow; moderate amount of yellow precipitate in the liquid which is clear, *i. e.*, not thickened; potato slightly browned. This serves to distinguish the organism from *Bacterium campestre* and *Bacterium phaseoli.* The potato becomes alkaline to litmus paper. Only a small portion of the starch is destroyed.

Nitrate Bouillon.—Does not reduce nitrates to nitrites.

Cohn's Solution.—No growth.

Milk.—After fifteen days the surface of the milk is yellow (canary yellow to a depth of 3 to 4 mm.). There is also a yellow rim 2 to 3 mm. wide. In the lower part of the tube the milk was cream color, and was not solidified. The yellow layer on the surface increased in depth until at the end of a month it was 10 to 12 mm. in depth and yellow, the milk below having become a deep cream color, thick and smooth like butter. At this time there was some yellow precipitate at the bottom of the tube. In another set of test-tube cultures the milk at the end of fifty days showed a yellow translucent whey 12 to 25 mm. in depth, the curd being deep cream color. There is probably a lab ferment.

Litmus Milk.—The litmus is reduced. At the end of fifteen days the medium was uniformly pale gray (Saccardo's griseus) and liquid throughout. After a month the litmus color had nearly all disappeared, the milk being dirty cream color and somewhat thickened.

Beef Bouillon.—The appearance at the end of fifteen days was as follows: Moderate clouding, thin white flocculent masses suspended in the medium. A moderate slimy precipitate, which rises in long strings on whirling; these break with shaking, but do not readily dissolve. No rim or pellicle. After another three weeks, rolling clouds, densest at surface, wide patches of rim, no pellicle; precipitate moderate, yellowish, viscid, rises in a swirl on whirling. Organism grows slowly in + 15 bouillon.

Gelatin Stabs.—Growth after five weeks scant, canary yellow, surface smooth, shining, slight in the stab, no liquefaction (temperature 14° to 15° C.).

Very little is yet known respecting the methods of natural infection or the period of incubation. I am inclined to think, however, that the infection takes place several weeks before there is any general indication of the disease in the fields, and possibly dates from the time of transplanting.

Sulphur Injury to Potato Tubers: Mr. W. A. Orton and Miss Ethel C. Field, Bureau of Plant Industry.

This paper is the outgrowth of experiments conducted in California in 1909 for the control of potato scab. Among other substances flowers of sulphur was used in varying quantities to disinfect soils where the scab fungus was present. On digging the crop, many tubers from the sulphured rows showed sunken, dark spots from 5 to 30 mm. in diameter, which were relatively free from fungous or bacterial infection. These spots occurred only in tubers from sulphured rows. They were more numerous in the heavily sulphured plots, but were present even where the seed piece had merely been dipped in sulphur. Potatoes exposed to sulphur fumes in the laboratory developed similar depressed spots.

This injury has apparently not been observed in the sulphur experiments conducted in the east. The California soils are peat and in late fall became quite dry near the surface, so that volatilization of the sulphur could easily have occurred.

Outbreak of Potato Canker (Chrysophlyctis endobiotica Schilb.) in Newfoundland, and the Danger of its Introduction into the United States: Dr. H. T. Güssow, Central Experimental Farm, Ottawa.

This well-known European potato disease has been recognized in specimens which I received from Red Island, Placentia Bay, N. F. The disease is due to a fungus of the order Chitridineæ and was named by its discoverer, Professor Schilbersky, in 1896, *Chrysophlyctis endobiotica*. The fungus attacks the tubers, but cases have been observed where the leaves closely above ground were also attacked. The changes due to the fungus on the tubers are very characteristic. Unfortunately the disease is not noticeable in the field until the crop is harvested, when it will be shown that the tubers are covered—according to the severity of the attack—either at the eyes only, or half or wholly by peculiar excrescences, not unlike the common crown galls of fruit trees. When a tuber is wholly covered with these excrescences they have lost all resemblance to potatoes and appear like irregular lumps of clay or coke. The fungus lives in the cells of these excrescences, which are not covered by the epidermis. It is present in these cells, first, as a more or less free plasmodium; second, as hyaline globular bodies, enclosed by a thick membrane and third, as yellowish brown resting spores very similar in appearance to those of the Peronosporæ. This latter stage is the most common one. The spores are very difficult to germinate artificially. Successful germination test showed that the spores burst and numerous swarm spores were liberated. These swarm spores infect new cells passing through the different stages—all of which are unsatisfactorily known—indeed it is doubtful whether there is any justification for the new generic name as described. The tubers decay by the action of the parasite and when harvested break to pieces and thus the soil becomes infected. The disease made its appearance in 1901 in England, is now present in Ireland, Scotland, Scandinavia, Germany and other European countries, but was not, until its discovery in Newfoundland, known on this side of the Atlantic. A visit to Newfoundland led to the discovery of the disease all over the neighborhood, and subsequently it was found to exist in other localities as well. As it was pointed out to me on inquiry that potatoes were imported in small quantities to the United States and Canada, great precaution is necessary to prevent the introduction and establishment of this serious pest. On account of the dangerous nature of the disease it was recommended that immediate action should be taken to safeguard the interest of the American and Canadian farmers, and a committee be appointed to consider the best means of dealing with the possible danger from its introduction into the United States. The fungus has also been referred to as *Œdomyces leproides* Trabut, but it is very different from this fungus, which according to Magnus is synonymous with *Synchytrium putxosam*.

Rhizoctonia Stem Rot of Beans: Mr. M. F. Barrus, Cornell University.

While working on bean diseases in the vicinity of Oneida, N. Y., during the summer of 1909, quite a large percentage of plants were noticed to be affected with a disease which caused cankers on the parts of the stem below or at the surface of the ground, these lesions frequently encircling the stem, causing it to break over and resulting in the death of the plant. In some fields as much as 30 per cent. of the plants became thus affected.

During the following season at the same place the disease was found to be as prevalent as it was the year before. In some fields it caused the death of at least 5–6 per cent. of the seedlings, and, later in the season after a rainy spell, a large percentage of the pods in contact with the ground became infected.

When diseased stems or pods were placed in a moist chamber over night a fine moldy growth surrounded them. Direct cultures made from the stem gave a pure culture of a fungus, which, from the character of mycelium and the production of sclerotia, showed that it belonged to the form genus *Rhizoctonia*. Interesting studies were made of its growth on various media. Inoculation of healthy plants grown in sterile soil resulted in the production of lesions characteristic of the disease, upon the inoculated plants, the checks remaining healthy. Subsequently from these lesions the fungus was again isolated and the characters of its growth noted. Inoculations were also made on healthy pods, in every case resulting in a characteristic *Rhizoctonia* canker. No perfect stage has yet been observed.

The writer is carrying on further experiments with this organism and with a culture of *Corticium vagum* in an effort to discover whether they are identical. Professor H. R. Fulton, formerly of the Louisiana Agricultural Experiment Station, carried on a considerable number of infection experiments during the summer of 1907 with a *Rhizoctonia* which he isolated from the bean pod, and produced lesions on seedling beans and on injured pods.

Observations on Apple-tree Anthracnose: Professor H. S. JACKSON, Oregon Agricultural College and Experiment Station. (Read by title.)

The Frog-eye Disease of Apple Leaves: Dr. JOHN L. SHELDON, University of West Virginia.

The history, cause and present distribution of this destructive disease of apple foliage are referred to briefly. Several reasons are given why it seems preferable to use the name "frog-eye" for the disease of apple leaves caused by *Illosporium malifoliorum* instead of the name "brown-spot." (Specimens of the diseased leaves were shown.)

The Ohio Outbreak of Fusarium Blight of Potato in 1909: Professor A. D. SELBY, Ohio Agricultural Experiment Station. (Read by title.)

On Mutualism in certain Parasitic Bacteria and Fungi: Mr. THOS. F. MANNS, Ohio Agricultural Experiment Station.

In artificially demonstrating the production of disease, the writer believes that in the past too little recognition has been given to the organisms associated with the specific cause of the disease. It seems quite probable that the intensity of the disease, together with the varying symptoms, depends quite largely upon the parts played by others than the specific organism. In past experimental work on disease production, we have proceeded by determining the specific organism and eliminating all the associated organisms. The writer believes that in the future, if we are to know more concerning the progress of disease and the cause of its virulence, we must take into account the rôle played by the intimately associated organisms.

During the past two years the writer has been working upon the blade blight or "red leaf" of oats; a disease which experimentally is shown to be due to bacteria. In this work two bacteria were associated in the diseased blades. Inoculation work with each of the organisms separately showed that one was specific and capable of producing limited lesions in the oat blade, while the second organism produced no lesions at all; however, when both the organisms were inoculated together as a mixture the typical oat blight symptoms followed. After repeated demonstrations with similar results, it was concluded that we have in these two organisms a mutualism or symbiosis in the production of this disease. Platings from the inoculation of the two organisms in mixture showed the presence of both the organisms throughout the resulting lesions. The writer has described the specific organism as *Pseudomonas avenæ* n. sp. and the associated organism as *Bacillus avenæ* n. sp.

On artificial media considerable advantage was noted in the growth and virulence of the specific organism when grown with the associated organism.

The writer believes there exists similar relationships among fungi in the production of disease, however, in these cases, the associated organism may be only a semiparasite, following closely on the heels of the specific organism. It seems probable also that such relationships as the latter may exist between the specific fungus and certain bacteria.

Such relationship suggests itself as prevailing between the *Fusarium* of potato wilt and a certain *Vermicularia* which is so frequently associated in culture work upon potatoes infected internally

with the *Fusarium*. Through artificial culture work it was found that 62.8 per cent. of the tubers from a certain field was infected internally with the *Fusarium*, along with which was also the *Vermicularia* to an extent of 10.3 per cent. Culture work upon beginning lesions in the stem and roots usually brought out both of the fungi.

No experiments have been carried out to show whether both these organisms are actually taking part in the production of potato wilt, although such experiments are now under way.

On a Laboratory Method of Determining the Fungicidal Value of a Spray Mixture or Solution: Dr. Donald Reddick and Mr. Errett Wallace, New York State College of Agriculture.

The method consists essentially of spraying slides or cover-glasses with a spray substance of a given formula. After proper drying and exposure spores of the pathogen are placed on them in a drop of meteoric water to germinate. This method more nearly simulates natural conditions than that of using a drop of the spray substance direct. Experimental data in connection with the conidia of *Venturia inæqualis* have been obtained which confirm the fact.

Mycological Studies upon Wheat and Wheat Soils to Determine Possible Causes in Deterioration in Yield: Professor T. D. Beckwith, North Dakota Agricultural College and Experiment Station. (Read by Professor H. L. Bolley.)

Analysis of soil solutions made from old wheat soil and from virgin prairie soil did not show sufficient differences to warrant the assumption that deterioration in yield is due to lack of plant food.

Culture studies made from old wheat soil and from virgin prairie soil show that certain soil fungi belonging to genera known to be pathogenic to some of the gramineæ are present in the soil cropped for years to wheat. They are almost lacking in virgin soil, the probabilities being that they are wind sown.

These fungi belong to the genera *Colletotrichum*, *Fusarium*, *Macrosporium* and *Alternaria*.

In order to ascertain whether spores of certain of these fungi were normally to be found on wheat stems a series of four hundred germination tests were carried out by placing them in moist culture tubes. Examination was made microscopically after five days' incubation at 30° C. Following are the results showing the percentages of wheat infected by these fungi:

Nodes	
Colletotrichum	90.0
Macrosporium	65.0
Helminthosporium	62.5
Cephalothecium	10.5
Internodes	
Colletotrichum	83.0
Macrosporium	50.5
Helminthosporium	58.5
Cephalothecium	9.0

This preliminary series showed the possibilities for infection. The spores of these forms either were resting on the wheat plants or else had already germinated there.

The next series consisted of another four hundred nodes and internodes, but this time they were sterilized by treating one minute with one per cent. formaldehyde and afterward washing with sterile distilled water. Thus it is presumed that all saprophytes and surface fungi were eradicated. These stems were then allowed to germinate as in the former series. Microscopic examination showed the following per cent. infection by the fungous genera given below:

Nodes	
Colletotrichum	57.0
Macrosporium	53.5
Helminthosporium	40.5
Fusarium	33.5
Internodes	
Colletotrichum	52.5
Macrosporium	33.0
Helminthosporium	34.5
Fusarium	27.5

Finally culture experiments made from roots of wheat grown in old wheat soil showed the presence of *Colletotrichum*, *Fusarium* and *Macrosporium*.

These tests seem to prove (1) old wheat soil is infected with certain fungi, (2) the spores or mycelium of certain of these fungi are to be found normally in or on the wheat plant grown on such land, (3) a certain per cent. of the wheat is pathologically infected with certain of these fungi, (4) certain of these fungi cause root infection.

Peach Yellows and Frost Injury: Mr. M. B. Waite, U. S. Department of Agriculture. (Read by C. L. Shear.)

There seems to be some confusion about these two troubles of the peach. It is the writer's opinion that peach yellows has no relation what-

ever to winter injury. Peach yellows is thought by the writer to be a contagious disease, though the germ has never been discovered. It behaves in many ways, though not in all respects, like pear blight. For example, when the pear blight germ is absent from a locality there can be no blight no matter how favorable conditions may be. In the same way peach yellows has a distinct range in the northern and eastern part of the United States. It has increased its area rather rapidly. No matter what the conditions may be of soil, climate, method of culture, fertilizer, etc., when the yellows reaches a district it attacks the orchards.

Pear blight has its ups and downs. Some years the conditions are favorable and some years unfavorable for the spread of the disease. Peach yellows behaves in the same way. Pear blight spreads from colonies or infection centers. Peach yellows behaves in exactly the same way.

Pear blight lives over winter in the "hold-over" cases, this becoming the new infection centers each spring. With peach yellows every case is a hold-over till the tree dies.

Pear blight can be inoculated artificially by introducing the germ or the diseased tissues. Peach yellows can be inoculated by introducing a bit of living tissue. Both diseases are unknown elsewhere in the world, although their host plants are foreign to this country and are cultivated widely over the earth.

Pear blight was mistaken for frost injury before its bacterial nature was discovered.

We know peach yellows as a distinct disease, through a number of definite symptoms. The distinctive symptoms of peach yellows are, first, the premature, red-spotted fruit; second, wiry or bushy vertical sprouts of a peculiar character. Peach yellows has also certain leaf symptoms, such as yellowing and curling. These symptoms are also shared by the disease known as "little peach." The leaf symptoms, however, are not entirely reliable, as somewhat similar symptoms, often difficult to distinguish, are produced by winter injury to various parts of the trunk, collar and root, the peach borer, the root aphis, sour soil, chlorosis, or even nitrogen starvation or soil poverty.

Frost collar girdle may even produce slightly premature fruit as other girdling will do, but it is not typical, for the yellows and the symptom would not be reproduced in budding. True yellows is often mixed up in the same orchards with frost injury and other similar confusing symptoms. Oftentimes, however, through examination of doubtful trees there will be found other symptoms than yellows.

Frost injuries, particularly, since 1903 and 1904, occurred from Michigan to New York and New England in the yellows area. The eastern part of the frost injury area overlaps a district in which there has been an extensive outbreak of yellows. This district extends from New England, eastern and southern New York to Tennessee and North Carolina. Frost injury has been severe without accompanying yellows in western New York, Ohio and Michigan. Yellows has been severe without frost injury in New Jersey, Delaware, Maryland, southern Pennsylvania to Tennessee and North Carolina. The overlapping of these two troubles in southern New York and New England need not, therefore, be confusing.

C. L. SHEAR,
Secretary-Treasurer

SOCIETIES AND ACADEMIES

THE CHEMICAL SOCIETY OF WASHINGTON

THE 198th meeting and annual smoker was held at Fritz Reuters on Thursday, April 14. The attendance at the smoker, which consisted of a beefsteak dinner, was 57. The following papers were read at the meeting:

The Effect of Drugs and Diet upon the Thyroid: REID HUNT.

Dr. Hunt discussed the changes in resistance of animals to certain poisons caused by the administration of various iodine compounds. Evidence was presented that some of these changes are caused by an effect upon the thyroid gland and that certain iodine compounds have a selective action upon this gland, that, in other words, they are thyreotropic. Diet also was found to have marked effects upon resistance to certain poisons; some of these effects seem to be exerted, at least in part, through the thyroid gland.

Contribution to the Knowledge of Phosphoric Acid: B. HERSTEIN and LYMAN F. KEBLER.

Dr. Herstein said, in part, that a method having been found to determine each of the three hydrates of phosphorus pentoxid, when mixed with one another, commercial glacial phosphoric acid and metaphosphoric acid as prepared in the laboratory, were subjected to a study, the results of which showed that: (1) contrary to the hitherto accepted theory, metaphosphoric acid in changing to the ortho-form first becomes pyrophosphoric acid; (2) the percentage rate of inversion is very little, if at all, influenced by dilution.

Extensive tables and diagrams were prepared in support of the above.